



Report to the Chairman, Subcommittee
on Interior, Environment, and Related
Agencies, Committee on Appropriations,
House of Representatives

January 2018

WATER AND WASTEWATER WORKFORCE

Recruiting
Approaches Helped
Industry Hire
Operators, but
Additional EPA
Guidance Could Help
Identify Future Needs

GAO Highlights

Highlights of [GAO-18-102](#), a report to the Chairman, Subcommittee on Interior, Environment, and Related Agencies, Committee on Appropriations, House of Representatives

Why GAO Did This Study

Safe operation of the nation's water utilities depends on access to a qualified workforce, particularly certified water operators. Industry reports have cited high rates of retirement eligibility and raised concerns about the water industry's ability to fill job openings.

GAO was asked to review workforce needs within the drinking water and wastewater industry. This report describes (1) what is known about workforce needs at water utilities compared with workforce needs nationwide and effects of potential unmet workforce needs on the utilities' compliance with the Safe Drinking Water Act and Clean Water Act; (2) approaches used by selected utilities to manage their workforce needs and challenges they have faced in managing those needs; and (3) ways in which federal programs can assist water utilities with workforce needs.

GAO reviewed workforce projections, relevant laws and regulations, agency documents, and industry studies and interviewed federal, local, and industry officials. GAO also conducted semi-structured interviews with a nongeneralizable sample of 11 water utilities, selected by size, location, and indications of workforce needs.

What GAO Recommends

GAO recommends that EPA add strategic workforce planning questions, such as the positions and skills needed in the future, to its inspection guidance documents. EPA generally agreed with GAO's recommendation as it related to drinking water, but neither agreed nor disagreed regarding wastewater. GAO believes the entire recommendation should be implemented.

View [GAO-18-102](#). For more information, contact J. Alfredo Gómez at (202) 512-3841 or gomezj@gao.gov or Cindy Brown Barnes at (202) 512-7215 or brownbarnesc@gao.gov.

January 2018

WATER AND WASTEWATER WORKFORCE

Recruiting Approaches Helped Industry Hire Operators, but Additional EPA Guidance Could Help Identify Future Needs

What GAO Found

Projections from the Department of Labor's Bureau of Labor Statistics (BLS) suggest that workforce replacement needs for water operators are roughly similar to workforce needs nationwide across all occupations; however, little is known about the effects of any unmet needs on compliance with the Safe Drinking Water Act and the Clean Water Act. BLS has projected that 8.2 percent of existing water operators will need to be replaced annually between 2016 and 2026. Although BLS projections are intended to capture long-run trends, rather than to forecast precise outcomes in specific years, this predicted replacement rate is roughly similar to the predicted rate of 10.9 percent for all workers across the U.S. economy. Limited information is available to determine whether retirements, or other workforce needs, are affecting drinking water and wastewater utilities' ability to comply with the Safe Drinking Water and Clean Water acts. At a national level, neither the water utilities' industry associations nor the Environmental Protection Agency (EPA) has analyzed whether there is a relationship between unmet workforce needs and compliance problems. EPA relies on states to inspect utilities to ensure compliance with the acts. EPA's inspection guidance documents, for both drinking water and wastewater, advise states to examine the quality and quantity of staff operating and maintaining water utilities. However, the guidance does not advise states to examine future workforce needs. GAO has found that future workforce needs can be identified through strategic workforce planning, which involves developing long-term strategies for acquiring, developing, and retaining staff to achieve program goals. By adding questions to EPA's inspection guidance on strategic workforce planning, such as the number of positions needed in the future, EPA could help make this information available for states to assess future workforce needs. Information on future workforce needs could help states and utilities identify potential workforce issues and take action as needed.

Representatives from 11 selected water utilities reported that by using various approaches, they were generally able to meet their current workforce needs but faced some challenges in doing so. Representatives from the selected utilities said that they recruit operators using word of mouth, websites, newspapers, and partnering with local technical schools. However, representatives from small utilities said that even with these approaches, they had difficulty hiring certified operators and instead hired and trained entry-level employees. Additionally, representatives from large utilities said they face difficulties in recruiting skilled workers, such as electricians and mechanics, part of a larger national pattern.

Five federal agencies that GAO reviewed—EPA and the Departments of Agriculture (USDA), Labor (DOL), Education, and Veterans Affairs (VA)—have programs or activities that can assist utilities with their workforce needs in several ways, including through guidance, funding, and training. EPA has worked with DOL and industry groups to develop a water-sector competency model to support industry training and with VA to help place disabled veterans in water industry jobs. In addition, USDA funds personnel who travel to rural utilities to provide hands-on assistance through its Circuit Rider program. Four of five small utilities GAO interviewed said they used this program and other USDA technical assistance for training operators.

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Abbreviations

EPA	U.S. Environmental Protection Agency
BLS	Bureau of Labor Statistics
DOL	U.S. Department of Labor
STEM	science, technology, engineering, and mathematics
USDA	U.S. Department of Agriculture
VA	U.S. Department of Veterans Affairs

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January 26, 2018

The Honorable Ken Calvert
Chairman
Subcommittee on Interior, Environment, and Related Agencies
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

Safe operation of the nation’s drinking water and wastewater utilities (water utilities) depends partly on continuous access to a qualified workforce, particularly sufficient numbers of certified water operators—workers who run the equipment and control the treatment processes for drinking water and wastewater.¹ According to the 2016 Environmental Protection Agency (EPA) Drinking Water Action Plan, a well-trained and knowledgeable workforce that implements proper assessment and management of water utility assets is vital to providing safe drinking water and ensuring the long-term sustainability of public water systems.² Yet some reports from industry groups have cited high rates of retirement eligibility and raised concerns about the potential rate of worker loss and water utilities’ future ability to fill job openings.³

¹According to the U.S. Department of Labor’s Bureau of Labor Statistics, water and wastewater treatment plant and system operators (hereinafter referred to as “water operators”) are individuals who “manage a system of machines, often through the use of control boards, to transfer or treat water or wastewater.” The specific duties of these water operators depend on the type and size of the plant. “In a small plant, one water operator may be responsible for maintaining all of the systems. In large plants, multiple water operators work the same shifts and are more specialized in their duties, often relying on computerized systems to help them monitor plant processes.” Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Water and Wastewater Treatment Plant and System Operators, accessed October 31, 2017, <https://www.bls.gov/ooh/production/water-and-wastewater-treatment-plant-and-system-operators.htm>).

²U.S. Environmental Protection Agency, Office of Water, *Drinking Water Action Plan* (November 2016).

³Water Environment Foundation, *Task Force on Workforce Sustainability Final Report* (Oct. 15, 2008); Terry Brueck, Marcia Isbell, Denise O’Berry, and Penny Brink, *Water Sector Workforce Sustainability Initiative* (Denver, CO: Water Research Foundation and American Water Works Association, 2010).

Staffing is largely a responsibility of the utilities themselves, but EPA and other agencies offer support for workforce development. EPA regulates drinking water and wastewater quality through the implementation of the Safe Drinking Water Act and the Clean Water Act, respectively,⁴ and both acts authorize EPA and the states to provide technical assistance to water utilities, which can be used to increase the technical knowledge and abilities of water operators. The U.S. Department of Agriculture (USDA) provides technical assistance to rural utilities through its Rural Utilities Service Water and Environmental Programs.⁵ Other federal agencies, including the Departments of Education, Labor (DOL), and Veterans Affairs (VA), have programs that offer support to employers and workers in a number of industries, and those programs are available to water utilities. DOL also measures labor market activity and working conditions in the overall U.S. economy through its Bureau of Labor Statistics (BLS). BLS collects, analyzes, and disseminates economic information, including nationwide employment projections for 10 years in the future.

You asked us to review workforce replacement needs—that is, the number of job openings for which employers replace workers who leave their current occupation—within the drinking water and wastewater industry.⁶ This report (1) examines what is known about workforce needs at water utilities compared with workforce needs nationwide and any effects of potential unmet workforce needs on the utilities’ abilities to comply with the Safe Drinking Water Act and the Clean Water Act; (2) describes approaches selected water utilities have used to manage their workforce needs and challenges they have faced in managing those needs; and (3) describes ways key federal programs can assist water utilities with their workforce needs.

To examine what is known about workforce needs at water utilities compared with workforce needs nationwide, we assessed and summarized data on workforce replacement rates provided by BLS and examined projected retirement rates provided by industry studies. We

⁴Safe Drinking Water Act, Pub. L. No. 93-523 (1974), codified as amended at 42 U.S.C. §§ 300f et. seq.; The Federal Water Pollution Control Act Amendments of 1972, Pub. L. No. 92-500, 86 Stat. 816, codified as amended at 33 U.S.C. §§ 1251-1387 et. seq. (commonly referred to as the Clean Water Act).

⁵For purposes of water and wastewater assistance, USDA uses the term “rural” to refer to utilities serving any area not in a city or town with a population in excess of 10,000 inhabitants.

⁶Throughout this report we refer to “workforce replacement needs” as “workforce needs.”

focused on projections of workforce turnover from 2016 to 2026 and estimates of employee retirement eligibility published from 2008 to 2016, the most recent data available to us. To assess the reliability of BLS data, we reviewed relevant documentation and information from BLS staff for the most recent data available for the two relevant BLS survey programs—one that collects data on wage and salary workers in about 800 occupations and one surveying households about labor force participation—and for BLS employment projections for 2016-2026. We determined that the BLS survey and projection data were sufficiently reliable for purposes of our objective. We identified a number of relevant industry studies including three surveys published by the American Water Works Association between 2015 and 2017.⁷ To assess the reliability of the industry studies, we reviewed their scope and methodology. Although the industry estimates were not generalizable, the studies were sufficiently reliable for illustrating the industry’s perspectives on workforce planning.

To examine the effects of potential unmet workforce needs on water utilities’ abilities to comply with the Safe Drinking Water Act and the Clean Water Act, we selected a sample of 11 water utilities—6 large and 5 small—based on geography, size, and indications of hiring challenges in the past.⁸ We included both large and small utilities in our selection based on our initial interviews with industry representatives that suggested that large utilities and small utilities have experienced different challenges. We asked officials of the selected utilities whether workforce challenges had affected their abilities to comply with the Safe Drinking Water Act and the Clean Water Act at their utilities and whether they anticipated effects on utility operations in the future. The information from those interviews is not generalizable to the national population of water utilities; it is intended to provide illustrative examples of difficulties selected water utilities have experienced in complying with the Safe Drinking Water Act and the Clean Water Act that they attributed to workforce challenges. We also obtained

⁷American Water Works Association, *2017 State of the Water Industry Report* (Denver, CO: 2017); American Water Works Association, *Benchmarking Performance Indicators for Water and Wastewater Utilities: 2015 Survey Data and Analyses Report* (Denver, CO: 2016); American Water Works Association, *Benchmarking Performance Indicators for Water and Wastewater: 2013 Survey Data and Analyses Report* (Denver, CO: 2015).

⁸EPA defines large utilities as those that serve more than 100,000 people. EPA defines medium drinking water utilities to be those that serve between 100,000 and 3,300 people, and small drinking water utilities to be those that serve fewer than 3,300 people. The selected utilities that we interviewed range between those that serve fewer than 3,300 people and those that serve greater than 500,000 people.

EPA data on compliance with the Safe Drinking Water Act and the Clean Water Act for the selected utilities. We have previously reviewed the quality of EPA compliance data.⁹ We determined that although the data were incomplete, they were useful to provide a rough indication of compliance; however, the violations may be underreported and, therefore, we cannot use the data to provide a precise indication of compliance.

To describe the approaches that selected water utilities have used to manage their workforce needs and the challenges they have faced in managing those needs over the past 5 years (from 2012 to 2016), we spoke with utility officials, during the interviews described above, to learn about their hiring and retirement numbers, challenges in managing workforce needs, and approaches for hiring staff.

To describe how key federal programs can assist water utilities with their workforce needs, we conducted background research and initial interviews with federal officials. We identified five federal agencies that conduct activities or provide funding related to the water utility workforce: EPA, USDA, Education, DOL, and VA. We interviewed officials with these agencies about current or past federal programs and policies related to water utilities' workforce needs. We did not attempt to identify all programs that can provide assistance to water utilities for workforce planning or recruitment, but we determined based on interviews at the five agencies that we had identified the programs for which providing such assistance was a primary purpose or likely use. Additionally, we interviewed representatives from the selected utilities we contacted to determine whether and how they had used various federal programs or assistance to augment other planning and recruitment strategies and what problems, if any, they had in using the programs. A more detailed description of the scope and methodology of our review is presented in appendix I.

We conducted this performance audit from September 2016 to January 2018, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe

⁹See GAO, *Drinking Water: Additional Data and Statistical Analysis May Enhance EPA's Oversight of the Lead and Copper Rule*, [GAO-17-424](#) (Washington, D.C.: Sept. 1, 2017).

that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

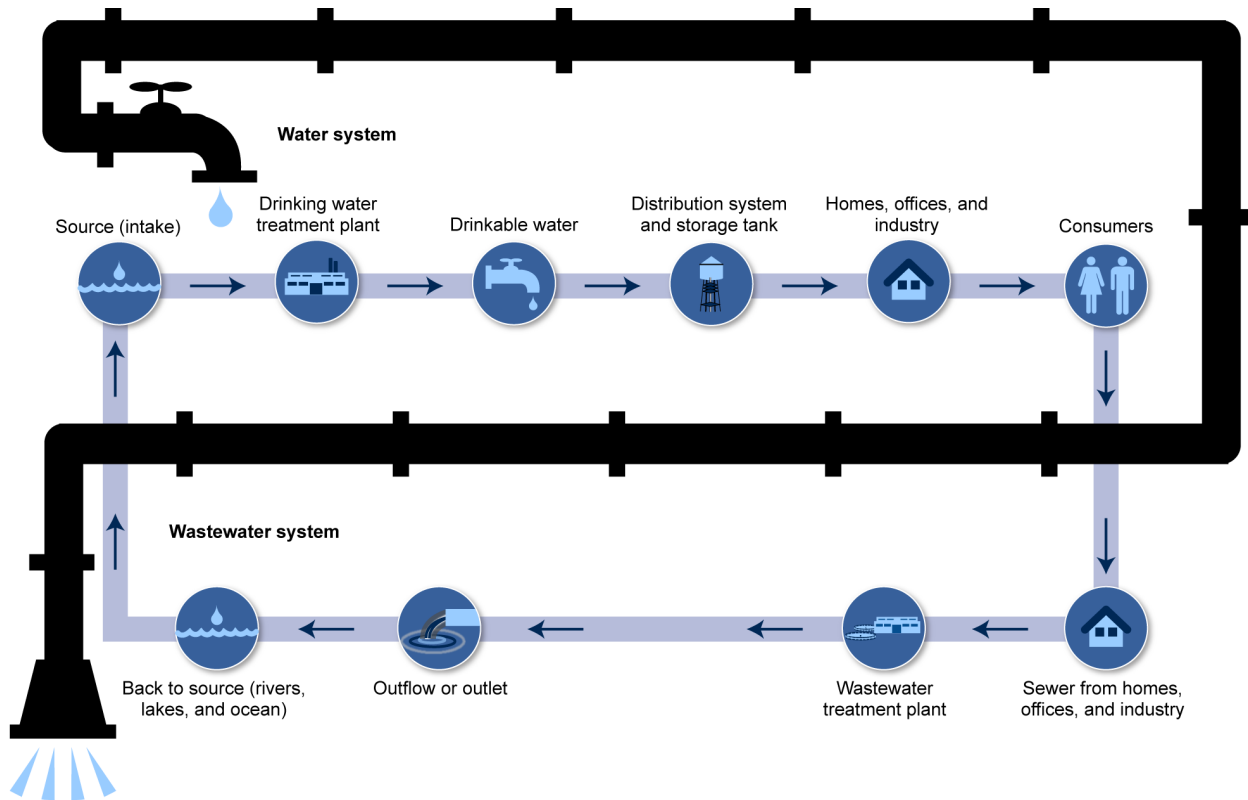
Background

The section presents information on (1) water utilities and water operators, (2) federal and state roles in overseeing and assisting water utilities, and (3) federal and state roles in workforce development.

Water Utilities and Water Operators

Water utilities provide drinking water and wastewater services, including drinking water treatment and distribution and wastewater collection, treatment, and discharge. Figure 1 shows the processes for treating and distributing drinking water and for collecting, treating, and discharging wastewater, which are overseen by water operators. Fresh water is pumped from wells, rivers, streams, or reservoirs to water treatment plants, where it is treated and distributed to customers. Wastewater travels through sewer pipes to wastewater treatment plants where it is treated and returned to streams, rivers, and oceans.

Figure 1: Water and Wastewater Services



Source: Water Research Foundation and Water Environment and Reuse Foundation, *National Economic and Labor Impacts of the Water Utility Sector: Technical Report* (San Francisco, CA: 2014). | GAO-18-102

Water utilities are organized differently depending on the city or community they serve. For example, drinking water service may be provided by one utility, and wastewater service may be provided by a separate utility, or a single utility may provide both services. Regardless of the configuration, a utility can be owned and managed by a municipality, county, independent district or authority, private company, or not-for-profit water association, among others. Utilities may serve a city and neighboring area, a county, or multiple counties. As of January 2016, there were about 52,000 drinking water and 16,000 wastewater utilities in the United States. These water utilities vary widely in the number of people they serve, but the majority of water utilities in the United States serve fewer than 10,000 people.

Water utilities employ a broad range of workers, including water operators; engineers; customer service representatives; accountants; legal support; and skilled technical occupations,¹⁰ such as electricians, machinists, and instrument technicians. It is difficult to find an estimate of total workforce at water utilities, but BLS reported that as of December 2016 employment in industries related to water utilities—including local government utilities (both water and energy utilities); water, sewage, and other systems; and water and sewer system construction—totaled 478,700. A study commissioned by the American Water Works Association estimated that 55 percent of water utility employees are water operators; of the remainder, 20 percent work in customer service and metering, and 25 percent work in administration of various kinds.¹¹ The number of water operators at individual water utilities depends partly on the size of the population the utility serves. Large utilities may have dozens of water operators supported by a staff of customer service representatives, electricians, instrument technicians, machinists, and plumbers. In contrast, utilities in rural communities may have a single water operator who is sometimes tasked with additional duties.

Water operators at drinking water utilities run the equipment, control the processes, and monitor the plants that treat water to make it safe to drink. Water operators at wastewater utilities do similar work to remove pollutants from domestic and industrial wastewater before it is reused or released into a receiving body of water. Many duties of water operators are technical and water operators need knowledge, skills, and abilities in science, technology, engineering, and mathematics (STEM). The list of academic competencies described in the DOL Water and Wastewater Competency Model for employment in the drinking water and wastewater industry includes calculating averages, ratios, proportions, and rates; translating practical problems into useful mathematical expressions; and understanding biology, chemistry, and physics. Water operators need to be able to prepare chemicals and confirm chemical strength, adjust chemical feed rates and flows, and understand software and equipment

¹⁰The National Academy of Sciences defines skilled technical occupations as those that require a high level of knowledge in a technical domain but do not require a bachelor's degree for entry.

¹¹American Water Works Association and Raftelis Financial Consultants, *2006 Water and Wastewater Rate Survey* (Denver, CO: 2006), as reported in *The Water Workforce: Recruiting & Retaining High-Performance Employees* (Denver, CO: American Water Works Association, 2009), 22-23. This report did not provide sufficient information to fully assess the reliability of the estimates.

used for industrial process control, such as supervisory control and data acquisition software and systems.¹² (See fig. 2). Industry representatives we interviewed told us that as drinking and wastewater treatment processes become more technologically advanced, water operators increasingly will need to have more advanced technical skills.¹³

Figure 2: Wastewater Plant Treatment Operator Reviewing Supervisory Control and Data Acquisition System



Source: © Suzanne Tennant. | GAO-18-102

Water operators must meet specialized certification requirements, which are overseen by state regulators. A number of 2-year and 4-year colleges offer programs across the country that provide training for individuals

¹²Supervisory control and data acquisition is a software application for process control, which consists of controllers, network interfaces, and communication equipment. Water operators use these systems to control utilities' water treatment processes.

¹³A December 2016 report from the President's Council of Advisors on Science and Technology found that to maintain a strong workforce of water operators and to attract new talent and younger entrants as the existing workforce reaches retirement, the United States needs to create new excitement around a technologically advanced drinking water workforce. They recommended that EPA, in coordination with the National Science Foundation, Education, and DOL, initiate a stakeholder process to develop a blueprint for the overall professional development of water treatment operators. President's Council of Advisors on Science and Technology, *Report to the President: Science and Technology to Ensure the Safety of the Nation's Drinking Water* (Washington, D.C.: 2016).

seeking certification as water operators. For drinking water operators, regulations under the Safe Drinking Water Act establish minimum standards for certifications. Each state must implement a water operator certification program that meets the requirements of these guidelines or that is substantially equivalent to these guidelines.¹⁴ The Clean Water Act does not have similar minimum requirements for wastewater operators, and certification standards are established by the states. Accordingly, there is no single standard national certification. Even though there has been an industry effort to harmonize the certification requirements across states for both drinking water and wastewater operators, reciprocity of certification between different states remains limited.

Federal and State Roles in Overseeing and Assisting Utilities

EPA regulates water utilities under the Safe Drinking Water Act and the Clean Water Act. Under the Safe Drinking Water Act, EPA establishes and enforces standards for public water systems, including drinking water utilities, that generally limit the levels of specific contaminants in drinking water that can adversely affect public health; attaining and maintaining these levels typically requires water treatment. Under the Clean Water Act, EPA regulates discharge of pollutants from point sources such as municipal and industrial wastewater treatment plants, and stormwater discharges from industrial facilities and municipal sewer systems. EPA's Office of Enforcement and Compliance has established national enforcement goals and works with state and tribal governments and other federal agencies to enforce the nation's environmental laws, including the Safe Drinking Water Act and Clean Water Act.

EPA authorizes most states to have primary enforcement responsibility—"primacy"—for the Safe Drinking Water Act, if the state meets certain requirements.¹⁵ Similarly, EPA authorizes most states to operate their own clean water discharge permitting program (also called primacy) in lieu of the federal program if the state program meets certain requirements.¹⁶ EPA regulations require states to have inspection programs for drinking water utilities—called sanitary surveys—to maintain their primacy. EPA regulations also require states to conduct periodic

¹⁴If a state fails to do so, EPA must withhold 20 percent of a state's annual funding under the Drinking Water State Revolving Fund program.

¹⁵All states have primacy except Wyoming.

¹⁶All states have primacy except Idaho, New Mexico, Massachusetts, and New Hampshire.

compliance inspections of wastewater utilities. These inspections support EPA's monitoring of compliance with the Safe Drinking Water Act and Clean Water Act. EPA provides states with guidance for evaluating the utilities. Inspections of drinking water utilities include eight areas of review: water sources, treatment plants, distributions systems, finished water storage, pumping facilities, monitoring plans and treatment records, management and operations, and water operator compliance with certification requirements. The inspections also function as an opportunity for state agencies to educate drinking water operators about proper monitoring and sampling procedures and to provide technical assistance. The goal of the inspections is to ensure that the utility can supply safe drinking water. For wastewater utilities, the inspections are more narrowly focused on monitoring the utilities' compliance with their Clean Water Act obligations. The goals of the wastewater utility inspections include identifying and documenting noncompliance and gathering evidence to support enforcement actions.

States receive federal funding for infrastructure projects and technical assistance under the Clean Water Act and Safe Drinking Water Act. EPA provides annual funding to states through its Drinking Water and Clean Water State Revolving Fund programs. States use this funding to support water infrastructure projects and to provide assistance to communities. Specifically, portions of a state's annual EPA funding may be used for implementation of, among other things, capacity development and water operator certification programs. Under the Safe Drinking Water Act, states are required to implement water operator certification programs, and EPA is required to withhold 20 percent of a state's Drinking Water State Revolving Funds if the state fails to do so. Under the Clean Water Act, states may use their Clean Water State Revolving Funds to provide assistance to any qualified nonprofit entity, to provide technical assistance to owners and operators of small- and medium-sized publicly owned wastewater treatment utilities to, among other things, help them achieve compliance with the act.¹⁷

Water utilities in rural communities also receive funding and technical assistance provided by USDA's Rural Utilities Service. The Rural Utilities

¹⁷A bill pending in the Senate, the Small and Rural Community Clean Water Technical Assistance Act, S. 518, would authorize the appropriation of \$25 million annually from 2018 through 2022 for the EPA to provide grants for training and technical assistance to publicly owned wastewater treatment utilities that serve communities with populations of fewer than 75,000 individuals.

Service provides funding for drinking water and wastewater infrastructure projects in rural communities. The Rural Utilities Service is one of three agencies under Rural Development—a USDA mission area focused on improving the economy and quality of life in rural America by providing financial programs to support essential public facilities and services such as drinking water and sewer systems, housing, health care, emergency service facilities, and electric and telephone service. The Rural Utilities Service’s Water and Environmental Programs provide loans, grants, and loan guarantees for drinking water, sanitary sewer, solid waste, and storm drainage facilities in rural areas. The Rural Utilities Service also provides funding for technical assistance to rural water utilities through a contract with the National Rural Water Association and grants to other nonprofit organizations.

Federal and State Roles in Workforce Development

Workforce development in the United States is driven by a variety of private and public investments in workforce education and development. Under the Workforce Innovation and Opportunity Act, the federal government has programs, administered primarily by DOL and Education, that provide a combination of education and training services to help job seekers obtain employment. Through these programs, DOL provides grants to states to provide funding for employment and training programs. Although the public workforce system receives federal funds, states may choose to add their own funding, and most of the system’s services for businesses and job seekers are delivered at the state and local levels. In implementing the Workforce Innovation and Opportunity Act,¹⁸ enacted in 2014, each state is to have a state-level workforce development board that develops strategies for providing outreach to individuals and employers and identifies in-demand industries.¹⁹

¹⁸Pub. L. No. 113-128, 128 Stat. 1425. The Workforce Innovation and Opportunity Act succeeded the Workforce Investment Act of 1998. Congress intended the former to, among other things, increase alignment of federal workforce-related programs.

¹⁹WIOA requires state boards to assist state governors in developing strategies to support the use of career pathways and the development or expansion of sector partnerships. Federal agencies require state plans to describe the strategies a state will implement, including career pathways and sector partnerships, to achieve its strategic vision and goals. The initial state plans under the act became effective on July 1, 2016. For more information on states’ early implementation of the Workforce Investment and Opportunity Act, see GAO, *Workforce Innovation and Opportunity Act: Selected States’ Planning Approaches for Serving Job Seekers and Employers*, [GAO-17-31](#) (Washington, D.C.: Nov. 15, 2016); and *Workforce Innovation and Opportunity Act: Information on Planned Changes to State Performance Reporting and Related Challenges*, [GAO-16-287](#) (Washington, D.C.: Mar. 7, 2016).

Helping ensure that the workforce system focuses on regional and local economies, each state is divided into one or more workforce areas, led by a local workforce development board. The local boards are responsible for, among other things, analyzing the employment needs of employers and the workforce development activities (including education and training) in the region. According to DOL, workforce boards are also responsible for determining how many American Job Centers²⁰ are needed in their area, where these centers will be located, and how they will be operated. There are about 2,500 American Job Centers across the United States that offer many resources under one roof. The typical center serves individuals seeking employment. Centers also work with employers to assess hiring needs; find qualified candidates, including veterans; connect to training options for new and current employees; and provide other workforce-related assistance.

Data Suggest Need for Water Operators Resembles Workforce Needs across All Occupations, but Little Is Known about Effects of Any Unmet Needs on Compliance

Data available from BLS suggest that the workforce replacement needs for water operators are similar to workforce replacement needs nationwide across all occupations. However, little information is available about the current and future effects of any unmet workforce needs on utilities' abilities to comply with the Safe Drinking Water Act and Clean Water Act.

²⁰Prior to the Workforce Innovation and Opportunities Act, American Job Centers were called "One Stop Centers" and other similar names. The act required the designation of a common name for the centers, and DOL and Education designated the name "American Job Center." According to DOL, the act also increased the quality and accessibility of services that job seekers and employers receive at the centers.

BLS Projections Indicate That the Replacement Needs for Water Operators Resemble the National Average for All Occupations

BLS projections suggest that the workforce replacement needs for water operators are similar to workforce replacement needs nationwide across all occupations. BLS uses survey estimates and economic models to project future employment in specific occupations; the latest such projections are for the 10-year period from 2016 through 2026.²¹ BLS intends its projections to capture the long-run trend, direction, and growth of the labor force rather than to predict precise outcomes in specific years. As of October 2017, the most recent projections indicate that the replacement needs for water operators—resulting from retirement or other separations—are relatively similar to the projected national annual average of replacement needs across all occupations (8.2 percent versus 10.9 percent, respectively).²² BLS projects that there will be an annual average of 9,200 job openings for water operators between 2016 and 2026. It also projects a slight decline in overall employment for water

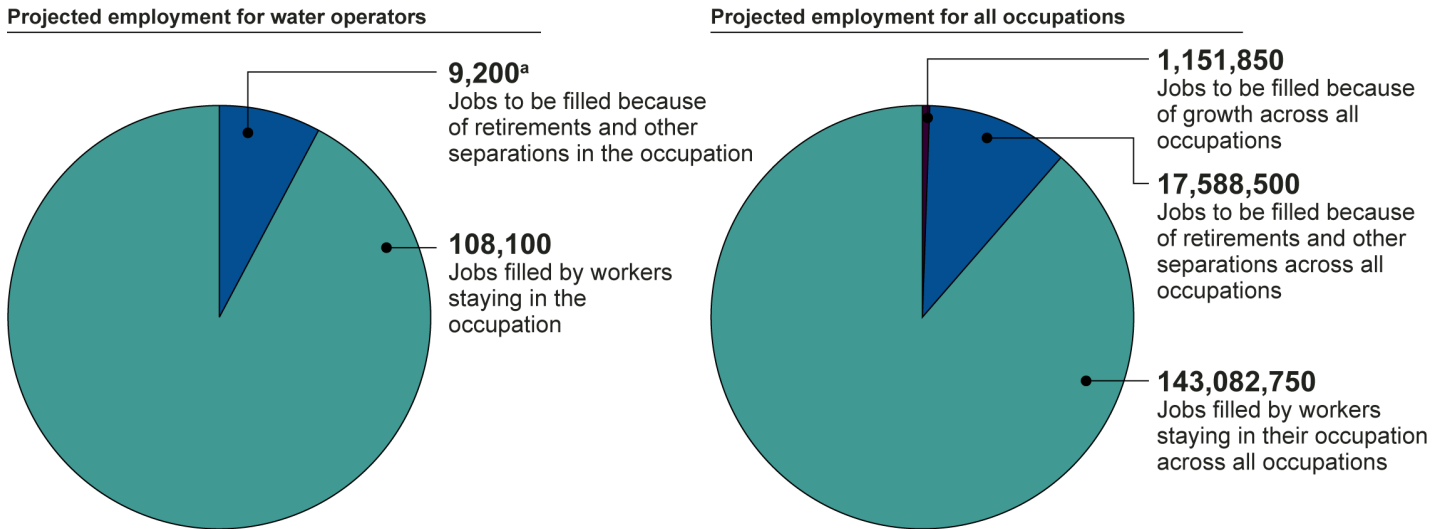
²¹BLS develops its employment projections from statistical and econometric models and designs these projections to provide an analysis of long-term trends based on a set of assumptions. The models and analyses BLS uses to develop the projections assume historical relationships and behavior will continue to hold over the projection period. However, there is uncertainty about whether historical trends will continue into the future. BLS employment projections rely on assumptions about demographics, fiscal policy (including tax policies and government spending), and macroeconomic conditions over the 10-year projection period. For example, the BLS projections assume that the economy will be at full employment in the last year of the period (e.g., 2026). BLS notes, however, that fluctuations in the business cycle are not foreseeable over a decade. (See T. Lacey, Mitra Toossi, Kevin Dubina, and Andrea Gensler, "Projections overview and highlights, 2016–26," *Monthly Labor Review* (Washington, D.C.: U.S. Bureau of Labor Statistics, October 2017), accessed November 2, 2017, <https://doi.org/10.21916/mlr.2017.29>.) Therefore, BLS projections are intended to capture the long-run trend, direction, and growth of the labor force, rather than as precise estimates of outcomes in specific years.

²²BLS notes that opportunities to enter an occupation will occur when workers leave an occupation permanently, resulting in the need to replace them. In most occupations, openings due to separations of existing workers provide many more opportunities than employment growth. BLS projects the number of separations by workers exiting the labor force because of retirements or other reasons (called "labor force exits"), and the number of separations by workers transferring to different occupations ("occupational transfers"). The total of those two projections combined comprise the "occupational separations," which represent an occupation's workforce replacement needs. (Note: The occupational transfers estimate does not count workers who change jobs but remain in the same occupation).

operators because of increasing automation at water utilities;²³ this decline contrasts with total employment across all occupations, which is projected to increase by an annual average of 1,151,850 jobs. On average, for years during this the 10-year period, BLS projects that about 8 percent of water operator jobs will be filled by workers replacing those who are separating from the occupation, and about 92 percent will be filled by workers staying in the water operator occupation. In comparison, over the same period for workers across all occupations, a projected annual average of about 1 percent of jobs will be filled because of growth, about 11 percent by workers replacing those separating from their occupation, and about 88 percent by workers staying in their occupation from the previous year. (See fig. 3.)

²³BLS data indicate that the number of employed water operators is a small fraction of the overall employed workforce—0.083 percent out of 140.4 million workers in non-farm related employment in 2016. The percentage of the workforce employed as water operators is an estimate subject to sampling error, with a 95 percent confidence interval of 0.081 percent to 0.084 percent. The number of workers is also an estimate, with a 95 percent confidence interval of 140,124,856 to 140,675,224. BLS, “May 2016 National Occupational Employment and Wage Estimates, United States,” *Occupational Employment Statistics*, last modified by BLS on March 31, 2017, accessed November 8, 2017, https://www.bls.gov/oes/current/oes_nat.htm#00-0000.

Figure 3: Annual Average Projected Employment for Water Operators and All Occupations, 2016-2026



Source: GAO analysis of BLS data. | GAO-18-102

Notes: BLS develops its employment projections from statistical and econometric models and designs these projections to provide an analysis of long-term trends based on a set of assumptions. BLS intends the projections to capture the long-run trend, direction, and growth of the labor force rather than to predict precise employment levels in the target year. The models and analyses BLS uses to develop the projections assume historical relationships and behavior will continue to hold over the projection period. However, there is uncertainty about whether historical trends will continue into the future, as unexpected events may occur. Therefore, BLS employment projections should be considered as likely outcomes based on specific assumptions, rather than as precise estimates of outcomes in specific years. See published data at Bureau of Labor Statistics, "Table 1.10, Occupational separations and openings," *Employment Projections: Occupational separations and openings*, last modified by BLS on October 24, 2017, accessed on October 24, 2017, https://www.bls.gov/emp/ep_table_110.htm.

^aBLS projects that employment for water operators will decline by an annual average of about 380 jobs. Therefore BLS projects that there will be no water operator jobs to be filled because of growth. The projection of 9,200 jobs to be filled because of retirements and other separations take into account this decline. BLS projects that there will be an annual average of about 9,600 occupational separations for water operators, but only 9,200 of those openings will need to be filled.

BLS tracks growth and workforce replacement projections for the water operator occupation, but not for water utilities; however, the water operator position is concentrated at publicly and privately owned drinking water and wastewater utilities. BLS estimates from May 2016 (the latest data set with data by type of employer) show that about 77 percent of water operators were employed by local governments—this percentage represents those employed at water utilities owned by cities and municipalities. Water, sewage, and other systems employed about another estimated 12 percent of water operators, which are primarily in

privately owned drinking water and wastewater utilities.²⁴ The remaining water operators (about 11 percent) were employed in state government or in various other private industries, such as waste treatment and disposal (e.g., solid waste, among other things).²⁵

BLS data indicate that the median age of water operators in 2016 was slightly older than the national median age of the workforce across all occupations. BLS does not collect information on tenure, retirement age, or retirement eligibility of workers; however, the 2016 Current Population Survey shows that 24.7 percent of water operators were age 55 or older, compared with 22.7 percent of the total U.S. workforce.²⁶ The data also show that in 2016, the median age for water operators was 46.4, compared with the median age across all occupations of 42.2.

²⁴The industry category "water, sewage, and other systems" also includes irrigation systems.

²⁵These occupational estimates are based on Occupational Employment Statistics survey data from May 2016. All estimates produced from this survey are subject to sampling errors. The estimated number of employed water operators is 115,840 from that set of data, which has a confidence interval from 113,342 to 118,338. Lastly, the actual estimated percentage of water operators employed by local government is 76.9 percent. The confidence interval for this estimate is 74.4 percent to 79.3 percent. Bureau of Labor Statistics, "Occupational employment and wages, May 2016: 51-8031 Water and wastewater treatment plant and systems operators," *Occupational Employment Statistics*, last modified by BLS on March 31, 2017, accessed on November 9, 2017, <https://www.bls.gov/oes/current/oes518031.htm>.

²⁶Bureau of Labor Statistics, "Household Data Annual Averages, Table 11b. Employed persons by detailed occupation and age," *Labor Force Statistics from the Current Population Survey*, last modified by BLS on February 8, 2017, accessed on November 11, 2017, <https://www.bls.gov/cps/cpsaat11b.htm>. These Current Population Survey estimates are subject to sampling errors. The 95 percent confidence intervals for these estimates are 10.6 percent to 38.7 percent (for the 24.7 percent estimate), and 22.6 percent to 22.9 percent (for the 22.7 percent estimate).

Industry reports from 2008 to 2010 included retirement eligibility estimates of as high as 30 to 50 percent of the water utility workforce.²⁷ However, industry representatives we interviewed told us that many workers postponed retirement during the recession that began in December 2007, thus reducing the industry’s hiring needs. The representatives added that retirements may increase as the overall U.S. economy continues to expand. In addition, industry representatives said that workers in the water industry tend to have a long tenure in their jobs, often working several years past the earliest age at which they meet the requirements for full retirement.

In addition to water operators, larger water utilities employ a broad range of workers, including skilled workers, such as electricians and machinists, as described above. While BLS does not provide employment projections specific to water utilities for these occupations, it does provide national employment projections for these occupations that can be illustrative. The future demand for such workers—as represented by projected job growth and occupational separations rates—is shown in table 1.²⁸ BLS defines the growth rate as the estimated percentage change in the projected number of jobs added or lost in a U.S. occupation or industry over a given period. The occupational separations rate is the sum of the projected percentage of workers exiting the labor force because of retirements or other reasons (“labor force exit rate”) and the projected percentage of workers transferring to different occupations (“occupational transfer rate”). Higher than average growth rates for the electrical and plumbing occupations, as well as higher occupational separations rates than the water operator occupation, suggest that the water industry will need to compete with other employers in faster-growing sectors, such as construction, for workers in these high-demand occupations.

²⁷A 2010 report sponsored by the Water Research Foundation and the American Water Works Association stated that 30 to 50 percent of utility workers would be eligible for retirement within the next 10 years, see Brueck, *et al*, *Water Sector Workforce Sustainability Initiative*. In making this statement, the authors cited a 2008 survey conducted by the American Water Works Association, which found, for responding utilities, that nearly a third of water utility executives and a quarter of water utility operators would be eligible to retire by 2013, see Jon Runge and John Mann, *State of the Industry Report 2008: Charting the Course Ahead* (Denver, CO: American Water Works Association, 2008). These reports did not provide sufficient information to fully assess the reliability of the estimates. The 2008 survey has limitations related to its methodology, such as a small sample size and self-selection issues. The percentages provided in the reports are not generalizable.

²⁸Bureau of Labor Statistics, *Employment Projections: Occupational separations and openings*, Table 1:10.

Table 1: Annual Average Projected Growth Rates and Occupational Separations Rates for Various Occupations Employed by Drinking Water and Wastewater Utilities, 2016 through 2026

Occupation	Projected growth rate (percentage)	Projected labor force exit rate (percentage)	Projected occupational transfer rate (percentage)	Projected total occupational separations rate (percentage)
Average of all occupations nationwide	7.4	4.7	6.2	10.9
Electricians	9.0	3.5	7.4	10.9
Plumbers, pipefitters, and steamfitters	15.8	3.6	6.7	10.3
Stationary engineers and boiler operators	4.8	3.2	7.0	10.3
Machinists	2.1	3.5	6.5	10.0
Maintenance workers, machinery	5.6	4.3	5.8	10.0
Water and wastewater treatment operators	-3.2	2.8	5.3	8.2

Source: GAO analysis of BLS data. | GAO-18-102

Note: The Bureau of Labor Statistics (BLS) develops its employment projections from statistical and econometric models and designs these projections to provide an analysis of long-term trends based on a set of assumptions. BLS intends the projections to capture the long-run trend, direction, and growth of the labor force, rather than predict precise employment levels in the target year. The models and analyses BLS uses to develop the projections assume that historical relationships and behavior will continue to hold over the projection period. However, there is uncertainty about whether historical trends will continue into the future, as unexpected events may occur. Therefore, BLS employment projections should be considered as likely outcomes based on specific assumptions, rather than as precise estimates of outcomes in specific years.

Limited Information Is Available on Unmet Workforce Needs and Their Effects on Compliance, and EPA Has Not Prompted States to Collect Information on Future Needs

Little is known about whether unmet workforce needs are affecting water utilities' overall abilities to comply with the Safe Drinking Water Act and Clean Water Act. At a national level, neither the water utilities' industry associations nor EPA has analyzed whether there is a relationship between unmet workforce needs and compliance problems. Some water utility industry associations have analyzed projected employee retirement eligibility and employee turnover, but these studies did not analyze the potential effect of these retirements on utilities' operations. The 2010 *Water Sector Workforce Sustainability Initiative* study sponsored by the Water Research Foundation and the American Water Works Association provides the most recent, broad industry evaluation of workforce challenges at water utilities.²⁹ That study outlined projected workforce challenges caused by impending retirements and shifting demographics

²⁹Brueck, et al., *Water Sector Workforce Sustainability Initiative*.

in the U.S. labor market, but it did not address specific operational impacts related to those retirements. Similarly, the American Water Works Association's annual benchmarking surveys collect data on utilities' water and wastewater regulatory compliance rates; however, the association does not analyze whether there is a relationship between retirement eligibility and regulatory compliance.³⁰

Water utilities and industry associations have some planned and ongoing work to learn more about workforce needs at water utilities. For example, representatives from one of the selected large utilities that we interviewed told us that a group of 16 large water utilities are informally working together to address workforce challenges and have proposed a major applied research project with the objectives of (1) exploring in greater depth the specific occupations, skills, and career pathways that can bridge the water sector's looming employment gap; (2) clarifying the range of water jobs available at a regional level; (3) identifying the potential pools of labor to fill these positions; and (4) exploring new development strategies to equip workers with the skills they need. Additionally, the Water Environment and Reuse Foundation is participating in an international Workforce Skills of the Future project to analyze future work scenarios and their impact on the water sector and develop recommendations for how the sector can prepare for and accommodate new capabilities and future skills in the water sector.

The utilities we interviewed had experienced compliance problems with the Safe Drinking Water and Clean Water acts and some difficulties in hiring certified water operators and other skilled workers. In our interviews with representatives of selected water utilities, the representatives reported that they had experienced some difficulties in hiring operators but that those difficulties had not had an effect on their utilities' compliance with the Safe Drinking Water Act or Clean Water Act to date. However, the representatives from 6 of the 11 selected utilities reported that their difficulties in replacing workers had resulted in a greater use of overtime to meet workload demands.

³⁰The American Water Works Associations publishes annual benchmarking surveys. For the 2016 benchmarking survey, see American Water Works Association, *Benchmarking Performance Indicators for Water and Wastewater: 2016 edition* (2016). The survey has limitations related to its methodology, such as a small sample size and self-selection issues. The percentages provided in the survey are not generalizable.

We reviewed EPA compliance violation data for the selected utilities and found that all of the utilities had at least one violation of either the Safe Drinking Water Act or Clean Water Act within the last 10 years; however, it was not possible to determine whether workforce challenges contributed to these violations. The violations represented a range of issues including exceeding the maximum contaminant levels in drinking water;³¹ failing to conduct regular monitoring of drinking water quality or to submit monitoring results in a timely fashion to the state agency or EPA; violating public notification requirements, which require systems to alert consumers if there is a serious problem with their drinking water; and failing to issue annual Consumer Confidence Reports.³² According to EPA officials, utilities may have violations for a number of reasons, including equipment breakdowns or impaired quality of source water, which makes water treatment more difficult. Because the compliance data is not specific enough to indicate the source of the problem, it was not possible for us to independently verify whether the compliance violations were linked to utilities' difficulties in replacing workers.

EPA relies on states to inspect utilities and ensure compliance with requirements under the Safe Drinking Water and Clean Water acts. EPA's inspection guidance—for both drinking water sanitary surveys and wastewater compliance inspections—advises states to examine the adequacy of water utilities' workforces—that is, the quality and quantity of staff operating and maintaining drinking water and wastewater facilities. EPA requires states to report some inspection information, including whether there are management issues at a utility.³³ EPA officials told us

³¹Under the Safe Drinking Water Act, EPA may establish an enforceable standard—called a maximum contaminant level—that limits the amount of a contaminant that may be present in drinking water. If EPA determines it is not economically or technically feasible to ascertain the level of a contaminant, the agency may instead establish a treatment technique to prevent known or anticipated health effects.

³²Community water systems must notify the public within specified times about the occurrence of health-based or monitoring violations and provide their customers with an annual Consumer Confidence Report containing data on the presence and concentrations of regulated contaminants.

³³EPA funded a study conducted by the Rural Community Assistance Partnership, published in 2016, that evaluated causes for failure of water systems to comply with drinking water regulations. The authors of that study examined information collected by states during drinking water utility inspections. The study identified 11 states that collect additional inspection information beyond that which EPA requires states to provide. The study described additional details that states captured under the inspection area of utility management and operations. See J. Oxenford and J. Barrett, "Understanding Small Water System Violations and Deficiencies," *Journal AWWA*, vol. 108, no. 3 (2016).

that, on the basis of their conversations with state regulators, they believe states are collecting information about workforce adequacy during state inspections of drinking water utilities. For wastewater utilities, EPA officials stated that in the course of conducting an on-site inspection, inspectors will ask plant managers and staff questions about staffing and should note concerns in their inspection reports. EPA officials said that collecting workforce information at the state level is beneficial for the states and the drinking water utilities so that they can take steps to implement strategies to address the utilities' workforce needs. The officials said state regulators can find patterns in utilities' compliance reporting data that alert them to the likelihood that a utility is experiencing operational issues, such as losing a certified water operator. In those instances, an EPA official told us, state regulators work with the utility to help identify solutions, such as locating a nearby water operator who can contract with the utility on a part-time basis until it can hire a permanent water operator. EPA officials further stated that they believe state regulators are using the workforce information to help build capacity at drinking water utilities and prioritize training.

However, the EPA inspection guidance that states currently use in conducting sanitary surveys for drinking water utilities and compliance inspections of wastewater utilities outlines criteria for evaluating existing workforce issues but does not address workforce issues that could affect utility operations, and potentially compliance, in the future. The guidance contains suggested assessment criteria that focus on whether there is an adequate number of qualified staff in the existing workforce to perform the work required. For example, the guidance for drinking water utilities states that the utility should have enough personnel to enable continuous operation of the treatment plant at all times and that staff should be able to perform operations and maintenance tasks regularly with little or no overtime hours. The inspection guidance does not contain similar questions that focus on whether there will be an adequate number of qualified staff in the future workforce to perform the work required. According to our December 2003 report, strategic workforce planning focuses on developing of long-term strategies for acquiring, developing, and retaining an organization's total workforce to meet the needs of the future.³⁴ In that report, we stated that while agencies' approaches to workforce planning will vary, there are five key principles that strategic

³⁴GAO, *Human Capital: Key Principles for Effective Strategic Workforce Planning*, GAO-04-39 (Washington, D.C.: Dec. 11, 2003).

workforce planning should address irrespective of the context in which the planning is done. These principles include:

- determining the critical skills and competencies that will be needed to achieve current and future programmatic results, and
- developing strategies that are tailored to address gaps in number, deployment, and alignment of human capital approaches for enabling and sustaining the contributions of all critical skills and competencies.

According to our interviews with selected utilities, five of the six large utilities had conducted workforce planning, while none of the small utilities had conducted such planning. By amending its inspection guidance with questions on strategic workforce planning—such as any potential gaps in critical skills and strategies to address any gaps in the number of water operator positions to meet the needs of the future—EPA could ensure that such information is available for states to assess future water utility workforce needs. Information on future workforce needs could help the states and water utilities identify potential workforce issues and take action as needed. According to EPA officials, they have not considered amending inspection questions but have heard that future workforce issues are a concern to the states and the industry and said that making such changes could be helpful to develop workforce strategies that address the specific needs of a state or regional area.

Selected Utilities Managed Their Workforce Needs Using a Mix of Approaches but Reported Ongoing Challenges Hiring Water Operators and Other Skilled Workers

Representatives from selected utilities that we interviewed reported using a mix of various approaches to meet their workforce needs. However, the selected large utilities reported ongoing hiring challenges with skilled technical workers such as machinists, electricians, and pipefitters.

Selected Utilities Used a Mix of Approaches to Manage their Workforce Needs

The representatives from the selected utilities reported that by using various approaches, they were generally able to hire water operators, but they faced some challenges in doing so. The number of water operator vacancies at each of the six selected large utilities in the spring of 2017, as reported by the utilities' representatives, ranged from 2 to 60, representing a range of about 2 to 15 percent of the utilities' water operator workforces. Only one of the five selected small utilities had a water operator vacancy in the spring of 2017. That utility had 1 vacancy among its workforce of 44 water operator positions. When we asked representatives of selected large utilities for their top three recruitment approaches for water operators, their responses included advertisements on their own websites, "word of mouth," advertising with professional water organizations, partnering with a local technical college, and use of general-purpose websites (not owned by the utility or a professional water organization). Similarly, responses from representatives of selected small utilities included "word of mouth," local newspapers, advertisements through professional water organizations, advertisements on general-purpose employment websites, and outreach to the local veterans' office.

We also asked the representatives of the selected large and small utilities about various water operator recruitment approaches described to us by association representatives or noted in industry publications. These approaches included recruiting from other states, working with local workforce boards and American Job Centers, establishing formal apprenticeships, reaching out to recruit veterans, and partnering with local technical and postsecondary schools. The representatives of large utilities reported that they used some of the approaches to varying degrees, but none of these representatives reported using all of them. The two most commonly used approaches of the selected large utilities (4 of the 6) were a partnership with one or more local community colleges to offer water treatment education, followed by reaching out to recruit veterans (3 of the 6). Representatives of one of the large utilities said they also had a partnership with a high school. Representatives of another large utility indicated that although they had access to local trade schools, the schools did not provide good candidates for the utility's jobs.

Representatives of one large utility said that the utility recruits out of state to find water operators with at least a minimum set of qualifications and a license because it lacks a local pool of water operators from which it can recruit. However, representatives of another large utility indicated that many water operators do not like to move from one state to another, and therefore it is difficult to recruit in other states. Representatives of the selected large utilities were divided about whether a national standard

certification for water operators would help with worker availability or recruiting. For example, one utility’s representatives said that a national standard certification would not help in recruitment, while representatives of another indicated that a uniform, transferable skill set, as represented by a national certification, would be helpful.

Representatives of the five selected small utilities reported that they generally had not used the various recruiting approaches about which we inquired. For example, according to their representatives, none of the small utilities recruited out-of-state water operators, in part because they preferred to recruit locally or they would not be able to attract such water operators with the relatively low compensation they could offer. In contrast to larger utilities, representatives of four of the selected small utilities told us they did not have a partnership with a trade school or a community college to offer water treatment education for various reasons, including filling key needs elsewhere and a lack of focus on water education at the technical college.

Selected Utilities Reported Ongoing Challenges Hiring Water Operators and Other Skilled Workers

Selected utilities reported ongoing challenges hiring water operators and other skilled workers. Representatives of all six selected large utilities told us that they had attempted to hire water operators during the past 5 years and, with one exception, they described hiring water operators as “somewhat difficult.”³⁵ Reasons they described for this difficulty included a lack of candidates with a STEM background, a distaste for shift work among younger employees, the lack of a local pool of candidates, and low pay. Representatives of three of the selected large utilities said hiring to replace departing water operators had been a problem in the past, but there was no consensus among the three on whether the problem was increasing, decreasing, or staying about the same. The utility that indicated the problem was decreasing cited two steps it had taken to address it: expanding its geographical search and improving its internal training program. Five of the selected large utilities reported that replacing retiring water operators was currently a problem, and three of them indicated that it could become one over the next 5 years for reasons such as water operators having to perform rotating shift work and fewer qualified candidates than in the past. The percentage of water operators

³⁵In our semi-structured interviews of the utilities, we asked officials of each one to rate their experience in hiring new water operators and other tasks according to a five-point scale: “Very easy,” “Somewhat easy,” “Neither easy nor difficult,” “Somewhat difficult,” or “Very difficult.”

eligible to retire over the next 5 years, compared to the total number of water operator positions in the six large utilities, ranged from a low of 100 out of 507 (about 20 percent) to 68 out of 136 (50 percent), the representatives told us.

Representatives of selected small utilities generally reported challenges recruiting and hiring certified water operators. Representatives of four of the five selected small utilities noted that replacing retiring water operators could become a problem over the next 5 years; these representatives often cited an inability to compete with larger utilities on compensation for certified water operators, in particular. Some representatives told us that, although they would have preferred to hire certified water operators for some of their vacancies, they often decided to hire and train an entry-level person, for whom there was less competition regarding compensation. Small utilities were roughly split regarding whether retirements had increased or remained about the same. Representatives of two small utilities told us that, over the past 5 years, the number of water operators retiring each year increased, but representatives of the other three reported that the number remained about the same. Representatives of two small utilities told us they have no water operators eligible for retirement during the next 5 years, and representatives of the other three small utilities reported that the number of water operators eligible to retire compared to the total number of water operator positions was, respectively, 2 of 6, 3 of 8, and 4 of 44. A representative of only one of the five small utilities reported difficulties recruiting skilled workers in professions other than water operators, and those professions are administrative and bookkeeping.

Skilled Technical Occupations

Considerable attention has been given in recent years to the question of whether the U.S. economy has a shortage of workers in skilled technical occupations—occupations that require a high level of knowledge in a technical area but do not require a 4-year college degree. The National Academies of Sciences, Engineering, and Medicine convened a committee to examine the coverage, effectiveness, flexibility, and coordination of the policies and programs that prepare Americans for skilled technical jobs. The committee organized a national symposium, held in June 2015, bringing together researchers, industry representatives, policymakers, and other stakeholders involved in technical workforce education and training. The committee's report, issued in 2017, contained many findings including: (1) the United States is experiencing, and will continue to experience, imbalances in the supply of and demand for skilled technical workers in certain occupations, industry sectors, and locations; (2) the nature of the problem differs across sectors and locations; (3) these imbalances arise from multiple sources; (4) the evidence suggests that, as a nation, the United States is not adequately developing and sustaining a workforce with the skills needed to compete in the 21st century.

Source: National Academies of Sciences, Engineering, and Medicine, *Building America's Skilled Technical Workforce* (Washington, D.C.: The National Academies Press, 2017). <https://doi.org/10.17226/23472>. | GAO-18-102

Representatives of the selected large utilities reported that, outside of water operators, the positions most difficult to fill are for other skilled workers such as machinists; electricians; pipefitters (also called “steamfitters”); and heating, ventilating, and air conditioning mechanics. The representatives of those utilities said that, in their experience, the number of young adults interested in the skilled technical occupations is decreasing. A representative of one small utility noted that it is difficult for trade schools and community colleges to offer courses in occupations for which student interest is declining. Because of projected reductions in the supply of such workers as the “baby boom” generation continues to retire over the next decade, the drinking water and wastewater industry has been one of many that have cited the “skills gap” and the need for a “pipeline” of future workers as developing problems as they attempt to fill vacancies caused by retirements. Representatives of some of the large utilities and industry associations we interviewed said that there are difficulties in filling certain skilled worker positions, particularly when local economic factors—including competition from other sectors such as construction—make it difficult to hire skilled technical workers if the local economy is near or at full employment.

Key Federal Programs Have Several Ways to Assist Utilities with Workforce Needs, and Selected Utilities Accessed Some of Those Programs

The five federal agencies we reviewed—EPA, USDA, Education, DOL, and VA—have programs that can assist utilities with their workforce needs in several ways, including through guidance, funding, and training. The selected utilities that we interviewed accessed federal programs to help meet their workforce needs in some instances.

Five Federal Agencies Have Key Programs That Can Provide Utilities with Guidance, Funding, and Training to Help Meet Workforce Needs

Key programs in EPA, USDA, Education, DOL, and VA can assist utilities with workforce needs in the ways described below.

EPA

EPA has several programs that can provide funding, through the states, for technical assistance to help water utilities meet their workforce needs. For example, EPA's national Training and Technical Assistance for Small Systems competitive grant provides, on average, \$12 million per year to give managerial and financial training to utilities, particularly small utilities. Additionally, officials stated that between 1997 and 2012, EPA provided \$134 million to help utilities train their water operator workforce and enable their water operators to gain certification through the Operator Certification Expense Reimbursement Grants program; however, this program ended in 2012. EPA's Public Water System Supervision Grant program provides grants to states for activities to implement drinking water regulations—activities that have included providing technical assistance to utilities, such as training to operators to ensure they are knowledgeable about the best operation and treatment practices. In addition, states may use up to 10 percent of the funding they receive for the Drinking Water State Revolving Fund allotment for specified program management activities, including the development and implementation of water operator certification programs.

In addition to funding technical assistance, EPA has assisted in efforts to attract new employees to the drinking water and wastewater industry. For example, in 2010 EPA partnered with the American Water Works Association and the Water Environment Federation to highlight the need for qualified professionals to enter the drinking water and wastewater industry. As part of those efforts, EPA produced a set of videos called "Water You Waiting For?" to encourage high school and vocational technical school students to consider employment in the industry. EPA officials also told us that based on industry requests, EPA has taken the lead in coordinating with other federal agencies to help develop a pool of potential certified water operators. EPA has also collaborated with DOL, USDA, and VA to assist drinking water and wastewater utilities in meeting their workforce replacement needs. For example, in 2009, EPA worked with DOL and industry groups to develop a competency model for the water sector, which was updated in 2016. The model defines the necessary knowledge, skills, and abilities for prospective water

professionals and can be used by educational institutions and industries to encourage prospective job seekers to consider a career in the water and wastewater industry by helping job seekers develop a career pathway and associated training and career advancement strategies that meet industry skill needs.³⁶ EPA has also entered into memorandums of understanding with USDA and VA, as discussed below.

USDA

In 2011, USDA and EPA signed a memorandum of agreement to support a series of activities to help small water and wastewater systems face the challenges of aging infrastructure, increased regulatory requirements, workforce shortages, increasing costs, and declining rate bases.³⁷ Part of that agreement focused on the water industry workforce. Among other things, USDA and EPA agreed to develop strategies for overcoming challenges specific to recruitment and retention of small utility water operators and to promote the use of contract water operators to fill workforce gaps in rural communities. As part of this effort, USDA and EPA also agreed to focus on the sustainability of rural utilities by coordinating activities and financial assistance resources to increase the technical, managerial, and financial capacity of rural drinking water and wastewater systems nationwide. This resulted in the development of a training workshop, the Sustainable Rural and Small Utility Management Initiative—“Workshop in a Box”—that covers a variety of topics, including

³⁶A competency model is one of the tools used by DOL to provide a clear description of what a person needs to know and be able to do to perform well in a specific job, occupation, or industry. According to industry groups, the Water Sector Competency Model was designed to increase the pool of certified and experienced water sector professionals.

³⁷The memorandum of agreement was to remain in effect for 5 years from the date of signing, and therefore expired in June 2016. At the time of this report, EPA and USDA officials stated that they had drafted a renewal of the memorandum and both agencies had forwarded the draft for legal review.

some related to evaluating workforce needs.³⁸ USDA reported that in fiscal year 2016, the technical assistance providers conducted more than 100 workshops, with at least one in each of the 50 states and Puerto Rico.

USDA's Rural Utilities Service provides technical assistance to small rural utilities through two programs: Technical Assistance and Training grants and the Circuit Rider program. The Technical Assistance and Training grants provide funds to private nonprofit organizations to help communities with water or wastewater systems by providing free technical assistance and training for rural water operators, other water utility staff and managers, and water utility board members. In fiscal year 2016, 24 nonprofit organizations received funding totaling about \$20 million to provide technical assistance to rural water utilities. In addition, under the Circuit Rider program, the Rural Utilities Service contracts with the National Rural Water Association to provide staff in each of the 50 states who offer technical assistance on day-to-day operational, managerial, and financial issues. Specifically, according to the National Rural Water Association, staff known as "circuit riders" work on site with rural water utility personnel to troubleshoot problems, evaluate alternative technological solutions, recommend operational improvements, assist with leak detection, respond to natural disasters and other emergencies, and provide hands-on training, among other things.³⁹ In fiscal year 2016, USDA provided about \$16 million for the Circuit Rider program.

³⁸The "Workshop in a Box" includes tools that were designed specifically for rural water operators and managers and can be found on USDA's website at <http://www.rurdev.usda.gov/UWP-WorkshopSupplementalMaterials.html>. One of the 10 key management areas in the workshop—Employee and Leadership Development—is specifically related to evaluating workforce needs at water and wastewater utilities. According to USDA, participants in the workshop assess their achievement in this management area using the following factors: (1) training programs are in place to retain and improve institutional knowledge; (2) opportunities exist for employee skills development and career enhancement; and (3) job descriptions, performance expectations, and codes of conduct are established. The workshop's intended audience consists of utility managers, other utility staff members who can contribute to or benefit from exploring management issues and challenges; utility board members; and local decision makers (e.g., elected officials).

³⁹According to USDA, the purpose of the Circuit Rider program is to protect the nation's multi-billion-dollar investment in rural and small municipal water systems by providing on-site technical assistance that assures cost-effective operations and adequate income for both operations and debt service within each state or jurisdiction. The primary objective of the program is for the circuit rider to work alongside the rural system officials and operators to show them how to solve their own problems.

DOL

DOL provides funding to states to operate the public workforce system under the Workforce Innovation and Opportunity Act. Under this act, DOL funds American Job Centers, where potential employees can seek information on job openings. Employers, such as industries or utilities, can notify the centers of the need for applicants, and the centers can then refer potential applicants to the industry. In addition, if requested to do so by industry associations or companies, DOL can work with them to develop registered apprenticeship programs through DOL's Office of Apprenticeship. As of September 2017, 24 water utilities across the country were training new employees through registered apprenticeships that combined structured learning with on-the-job training with an assigned mentor. (See app. II for a list of apprenticeships in the water industry that are registered with DOL's Office of Apprenticeship.) In addition, the National Rural Water Association recently developed a registered apprenticeship program for rural utilities. According to DOL officials, the program began in Indiana on August 10, 2017, and as of September 7, 2017 two additional states—California and Colorado—were expected to join the apprenticeship program.

In addition to funding under the Workforce Innovation and Opportunity Act, between 2011 and 2014, DOL awarded \$1.9 billion in capacity-building grants to community colleges through the Trade Adjustment Assistance Community College and Career Training grant program. Grantees identified in-demand industries and sectors in their proposals and were required to partner with workforce boards. At least seven grantee colleges proposed to develop or upgrade programs of study related to water and wastewater utilities. For example, Salina Area Technical College (Kansas) developed an environmental technology associate's degree program focusing on water quality and wastewater treatment management.⁴⁰

Education

Through multiple grant programs, Education provides funding for states and community and technical colleges, including a number of community and technical colleges that offer programs to prepare individuals for careers in the drinking water and wastewater industry.⁴¹ Examples of

⁴⁰Open Educational Resources developed for these and other Trade Adjustment Assistance Community College and Career Training grant-funded, water-related programs of study can be found by searching the term "water" on www.SkillsCommons.org, the grant's digital library of workforce training materials.

⁴¹The Carl D. Perkins Career and Technical Education Act of 2006 (the Perkins Act) authorizes funding to develop more fully the academic and career and technical skills of

such colleges include Kirkwood Community College (Iowa), Moraine Park Technical College (Wisconsin), and Bay College (Michigan). According to agency documentation, three funding mechanisms can be used to fill the training and employment needs of the water and wastewater industry:

- Funding under the Perkins Act is available for state agencies and eligible local educational agencies and postsecondary education providers.⁴²
- Funding under the Adult Education and Family Literacy Act is available to state agencies and eligible providers for, among other things, integrated education and training, which is a service approach that provides adult education and literacy activities concurrently and contextually with workforce preparation activities and workforce training for a specific occupations.
- The Rehabilitation Act of 1973 provides funding for training and job placement services for individuals with disabilities through state vocational rehabilitation agencies. According to agency documentation, from fiscal years 2013 through 2016, nationwide in this program, 40 to 50 program participants per year obtained employment as operators in the drinking water and wastewater industry.

VA

In 2012, EPA and VA's Vocational Rehabilitation and Employment Service signed a memorandum of understanding in which the agencies agreed to work on promotional activities that would help advance and

secondary and postsecondary education students who elect to enroll in career and technical education programs. The Adult Education and Family Literacy Act provides funds to states, which grant these funds to eligible providers to assist adults in, among other things, becoming literate or achieving proficiency in English, obtaining the knowledge and skills necessary for employment and self-sufficiency, and completing a secondary school education. The Rehabilitation Act of 1973 provides funding to states for vocational rehabilitation services, such as counseling, job training, and job search assistance to eligible individuals with disabilities, with emphasis on individuals with significant disabilities. These programs are delivered through American Job Centers.

⁴²Eligible institutions include public or nonprofit private institutions of higher education that offer career and technical education courses that lead to technical proficiency, an industry-recognized credential, a certificate, or a degree.

improve employment opportunities for veterans with disabilities.⁴³ According to the memorandum of understanding, veterans represent a major recruiting opportunity for water utilities. According to the EPA and VA memorandum of understanding, prior military experience gives veterans an understanding of teamwork, discipline, and personal accountability that can make them excellent employees in these fields. In addition, many veterans already have technical skills and training that are directly transferrable to careers in the drinking water and wastewater industry. EPA also worked with VA to create Military Occupational Specialty equivalent job descriptions for water-related military jobs to show how they equate to civilian water utility jobs. Under the memorandum with EPA, VA receives referrals of open positions from the water and wastewater industry and disseminates the information to disabled veterans who are looking for jobs. According to a VA official, over the past 5 years, the VA estimated sharing nearly 5,500 water utility job leads with its 56 regional offices and the National Capital Region Benefits Office. VA tracks the number of disabled veterans who have been rehabilitated to employment, but it does not track the number of disabled veterans who take jobs at water utilities.⁴⁴

⁴³The memorandum of understanding is to remain in effect until terminated by either or both parties but is to be jointly reviewed at 5-year intervals from the date of signature, which was April 2012. As of the writing of this report, EPA and VA were exploring whether to renew or revise the memorandum. EPA officials expressed a desire to renew and expand the memorandum beyond disabled veterans, while VA officials stated that an updated memorandum is not necessarily required to continue to provide support on disseminating available opportunities for disabled veterans to its field offices.

⁴⁴In responding to a draft copy of this report, VA stated that its Veterans Benefits Administration will work with the 56 regional offices to determine if recruitment with the water utilities is beneficial for their Vocational Rehabilitation and Employment participants, and track how many disabled veterans have been placed in the specific employment opportunities, as feasible. VA stated that it will begin an assessment to determine if recruitment with water utilities is beneficial and feasible in the second quarter of fiscal year 2018.

Selected Water Utilities Accessed Some Federal Programs to Help Meet Workforce Needs

Strategies under the Workforce Innovation and Opportunity Act

In implementing the Workforce Innovation and Opportunity Act, states are required to incorporate specified strategies in their state plans, including the following:

Career pathways strategies help job seekers obtain education and job experience leading to a career. Career pathways strategies align and integrate education, job training, counseling, and support services to help individuals obtain postsecondary education credentials and employment in in-demand occupations.

Sector partnership strategies engage related groups of stakeholders (including employers) in the workforce system. Such strategies organize multiple employers and key stakeholders, such as education and training programs, in a particular industry into a working group that focuses on the shared goals and human resources needs of that industry.

Source: GAO, *Workforce Innovation and Opportunity Act: Selected States' Planning Approaches for Serving Job Seekers and Employers*, GAO-17-31 (Washington, D.C.: (Nov. 15, 2016). | GAO-18-102

The selected utilities that we interviewed provided examples of federal programs that they are using to help meet workforce needs. The 2010 report sponsored by the Water Research Foundation and the American Water Works Association identified a number of actions that water utilities could take to address workforce issues, including actions that made use of federal programs, such as:

- working with DOL to identify standard workforce competencies and career pathways;
- working with workforce investment boards in each state to integrate and fund training initiatives for the water utility industry; and
- working with Education to develop training requirements for the water utility industry.

Representatives of the American Water Works Association told us that they had not provided tools or outreach to utilities to help them act on some of these recommendations, such as working with local workforce investment boards. In our interviews with selected utilities, we heard that there is variation in whether the utilities have accessed federal programs to help meet their workforce needs.

Programs for Rural Utilities (USDA)

Representatives from four of the selected small utilities we interviewed said they use training programs offered by the National Rural Water Association to train the water operators they hire. A representative from one small utility stated that his utility needed the National Rural Water Association to provide ongoing training for new operators. The representative also stated that the National Rural Water Association's circuit riders helped the utility resolve problems that arose, which precluded the need for the utility to pay for expensive private services. Circuit riders can help small utilities resolve a range of problems, including assisting with leak detection and responding to natural disasters and other emergencies.

American Job Centers (DOL)

Representatives from two of the selected large utilities and two of the selected small utilities told us that they had used the American Job Centers to recruit potential workers. Representatives of those utilities described differing experiences in using their local job centers, with

representatives from one large utility stating that the job center was a good resource for them while representatives from another large utility stated that they were not able find the type of candidates they wanted (such as those with a STEM background). Representatives of other selected utilities stated that they have not used the centers either because they were not familiar with the centers' services or they did not believe that using the job centers would be beneficial for them.

Sector Partnership Strategy (DOL)

Get Into Water!

The Colorado Department of Labor and Employment and the Colorado Workforce Development Council jointly awarded funding to plan a sector partnership strategy for the drinking water and wastewater industry. The funding provided by Colorado was part of federal Workforce Investment Act funds provided to the state for sector partnership strategies. The initiative, called "Get Into Water!" involved four counties in the Denver metro region. Although the drinking water and wastewater industry was not among the top three industries in those counties, a study of the region's drinking water and wastewater utilities identified workforce challenges and opportunities in the region. The initiative, which was active between 2009 and 2011, developed entry-level training courses to introduce high school students and adults to career opportunities in the drinking water and wastewater industry. One of the programs that was developed—at Emily Griffith Technical College—remains active after the conclusion of the initiative.

Source: GAO summary of Colorado's Get Into Water! documentation. | GAO-18-102

One of the selected large utilities that we interviewed was involved in a sector partnership strategy called "Get Into Water!" funded by the Colorado Department of Labor and Employment and the Colorado Workforce Development Council. The funding provided by Colorado was a part of federal Workforce Investment Act funds provided to the state for sector partnership strategies. None of the other selected large or small utilities reported taking part in a federally funded sector partnership strategy.

Registered Apprenticeships (DOL)

One of the selected large utilities we interviewed used DOL's registered apprenticeship program as a way to recruit and hire water operators. It also used the apprenticeship to cover plumbers. None of the other selected large utilities had registered apprenticeship programs for water operators. Representatives from some of the selected large utilities stated that they did not use registered apprenticeships because of the expense of meeting the apprenticeship rules—particularly having to pay almost the market rate to an apprentice, who may not be fully productive for the first few years on the job. Representatives from some of the selected small utilities stated that they did not need an apprenticeship program because of their small size or lack of openings.

Initiatives to Employ Veterans (VA, DOL)

The selected utilities used various methods to recruit veterans, including working with state and local veterans offices, job fairs, and coordinating with local military installations. Four of the selected large and small utilities we interviewed sought to hire veterans, but none of them sought employees through the VA's disabled veterans program. DOL noted that American Job Centers offer additional ways to recruit and hire veterans, including the Jobs for Veterans State Grants program, which funds Disabled Veteran Outreach Program specialists and Local Veterans' Employment Representatives. Representatives from one of the large utilities stated that although it did not have a program specifically for recruiting veterans, it periodically sent its employees to talk to groups of veterans about the nature of its work and how to navigate the civil service hiring process.

Conclusions

Having an adequate number of trained and qualified employees, particularly water operators, is key to the safe operation of the nation's water utilities. Water utilities face an upcoming wave of retiring baby boomers, similar to other industries in the economy. Federal programs offer many resources that, if accessed, have the capability to support and supplement—but not replace—utilities' individual and collective efforts to recruit for difficult-to-fill positions. EPA has coordinated efforts with DOL and other federal agencies that can help utilities and industry groups identify ways for utilities to access federal programs. EPA's inspection guidance documents recognize the importance of utilities having an adequate number of capable and qualified staff, and state regulators appear to be capturing some information on utilities' existing workforce capacity and using this information to target technical assistance to utilities in need. However, EPA's inspection guidance to states does not address future workforce issues that may affect utility operations. By adding questions to its inspection guidance documents on strategic workforce planning—such as the number of positions needed in the future, skills needed in the future, and any potential gaps in water operator positions—EPA could help ensure this information is available for states to assess future workforce needs. Information on future workforce needs could help states and utilities identify potential workforce issues and take action as needed.

Recommendation for Executive Action

The Assistant Administrator for Water should direct EPA's Office of Water to amend its Safe Drinking Water Act and Clean Water Act inspection guidance documents to add questions on strategic workforce planning topics—such as the number of positions needed in the future, skills needed in the future, and any potential gaps in water operator positions. (Recommendation 1)

Agency Comments and Our Evaluation

We provided a draft of this product to EPA, USDA, Education, DOL, and VA for comment. Education, DOL, and VA provided technical comments, which we incorporated as appropriate. In a written response, USDA indicated that it did not have comments and generally agreed with the report findings and content.

EPA provided written comments, reproduced in appendix III, in which it generally agreed with our findings and provided comments regarding the conclusions and recommendation. While EPA generally agreed with our findings, the agency stated that the report does not highlight some factors that differentiate water and wastewater sector workforce needs from the workforce needs of all occupations. EPA stated that, for example, the location of the drinking water system or wastewater treatment plant can significantly impact the owner's ability to recruit and retain certified operators. We examined workforce needs in terms of projected growth and occupational separations rates as reported by BLS. We did not specifically assess the impact of geographic location. However, in our discussion of responses from selected small utilities, we outline some of the particular challenges facing small water utilities, which are typically located in more rural areas. We describe, for example, that representatives of small utilities often cited an inability to compete with larger utilities on compensation for certified water operators.

With regard to our recommendation, EPA stated that it generally agrees with the recommendation with respect to sanitary surveys of public water systems. It further stated that EPA's Office of Ground Water and Drinking Water is in the process of updating the sanitary survey guidance manual *How to Conduct a Sanitary Survey of Drinking Water Systems – A Learner's Guide*. EPA noted that they will add questions related to workforce needs to the "Utility Management" section and anticipates finalizing the update by the summer of 2018. For compliance monitoring inspections under the Clean Water Act National Pollutant Discharge Elimination System (NPDES) program, EPA did not agree or disagree with the recommendation, but stated that inspectors may be limited in the information related to workforce planning they can assess and provide because there is no corollary to the Water System Management and Operation element of sanitary surveys in the NPDES compliance inspections. EPA stated that where the agency identifies studies or documents on adequate staffing of wastewater facilities, its Office of Enforcement and Compliance Assistance will incorporate that information into its existing guidance documents for inspectors. While we recognize that the sanitary surveys and NPDES compliance inspections have different goals, as we noted in the report, inspectors currently ask plant

managers and staff questions about staffing, and we believe that there is an opportunity to ask additional questions about future staffing needs. In addition, we note that EPA already highlights the need for adequate staff in its compliance inspection guidance. By amending the compliance inspection guidance to instruct inspectors to also ask about future workforce issues, EPA would be emphasizing the fact that ensuring a trained workforce and continuity of operations is important for complying with NPDES permits.

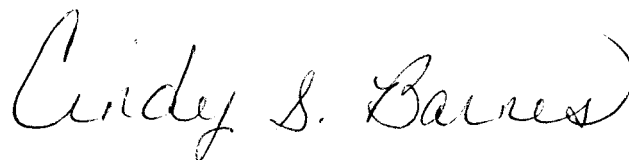
We are sending copies of this report to the appropriate congressional committees, the Administrator of EPA, the Secretary of Agriculture, the Secretary of Education, the Secretary of Labor, the Secretary of Veterans Affairs, and other interested parties. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact us at (202) 512-3841, gomezj@gao.gov or (202) 512-7215, brownbarnesc@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix IV.

Sincerely yours,



J. Alfredo Gómez
Director, Natural Resources and Environment



Cindy Brown Barnes
Director, Education, Workforce, and Income Security

Appendix I: Objectives, Scope, and Methodology

This report examines (1) what is known about workforce needs at water utilities compared with workforce needs nationwide and any effects of potential unmet workforce needs on the utilities' abilities to comply with the Safe Drinking Water Act and the Clean Water Act; (2) what approaches selected water utilities have used to manage their workforce needs and challenges they have faced in managing those needs; and (3) in what ways, if any, key federal programs can assist water utilities with their workforce needs.

To examine what is known about workforce needs at water utilities compared with workforce needs nationwide, we assessed and summarized data on workforce replacement rates provided by the Department of Labor's Bureau of Labor Statistics (BLS) and examined projected retirement rates provided by industry studies. We focused on projections of workforce turnover from 2016 to 2026 and estimates of employee retirement eligibility published from 2008 to 2016, the most recent data available to us. Because BLS estimates of workforce replacement needs do not distinguish between workers who retire and workers who permanently leave an occupation for other reasons, it was not possible to isolate retirements from other separations.¹

We identified two relevant BLS survey programs—the Occupational Employment Statistics program (May 2016)² and the Current Population Survey (2016)³—and one BLS projection program, the Employment

¹According to BLS's website, projections of job growth provide valuable insight into future employment opportunities because each new job created is an opening for a worker entering an occupation. However, opportunities also arise when workers leave their occupations and need to be replaced. In most occupations, replacement needs provide many more job openings than employment growth does. To project the magnitude of replacement needs, BLS calculates an estimate of openings resulting from workers retiring or otherwise permanently leaving an occupation. This estimate of replacement needs does not count workers who change jobs but remain in the same occupation.

²Through its Occupational Employment Statistics program, BLS conducts a semi-annual mail survey to collect data on wage and salary workers in nonfarm establishments. It uses these data to produce employment and wage estimates for over 800 occupations that are included in the Standard Occupational Classification System. BLS last modified and posted the applicable May 2016 survey results to its website in March 2017.

³The Current Population Survey is a monthly survey of households conducted by the U.S. Census Bureau for BLS. The basic monthly survey gathers demographic characteristics of people in each household and information to determine whether they are employed, unemployed, or not in the labor force. The survey collects information on workers' occupations and ages, which is of particular interest for employment analyses. BLS last modified and posted the applicable 2016 annual average survey results to its website in February 2017.

Projection Program (2016-2026).⁴ To assess the reliability of BLS survey data, we reviewed relevant documentation and information from BLS staff for the most recent data available for the two relevant BLS survey programs. Through the Occupational Employment Statistics program, BLS conducts a mail survey in May and November of each year to collect data on wage and salary workers in nonfarm establishments. It uses these data to produce employment and wage estimates for about 800 occupations. BLS publishes relative standard errors to account for sampling errors in Occupational Employment Statistics survey estimates. All Occupational Employment Statistics estimates in this report are presented along with their 95 percent confidence level.

The Current Population Survey is a monthly survey of households conducted by the U.S. Census Bureau for BLS. It is a sample survey of 60,000 eligible households representing the civilian noninstitutional population ages 16 and older in the 50 states and the District of Columbia. The basic monthly survey gathers demographic characteristics of people in each sampled household and information to determine whether they are employed, unemployed, or not in the labor force. The survey collects information on workers' occupations and ages. The Current Population Survey estimates presented in this report are subject to sampling error. To account for this error, we present all Current Population Survey estimates in this report along with their 95 percent confidence intervals. Data that would allow us to calculate true sampling errors were not specifically provided by the Current Population Survey. Instead, we followed Current Population Survey guidance to estimate sampling errors. We used generalized variance functions, parameters, and factors published by the Current Population Survey to calculate approximate standard errors and confidence intervals. As a result, the confidence intervals presented in this report provide a general order of magnitude and are approximations of the true sampling errors.

To assess the reliability of BLS projections, we reviewed relevant documentation and information from BLS staff for the most recent projections available and reviewed the BLS employment projections in the

⁴The Occupational Outlook Handbook includes employment projections for a 10-year period developed by the Employment Projections program at BLS. BLS develops its employment projections from statistical and econometric models and designs these projections to provide a focused analysis of long-term trends based on set of assumptions. BLS last modified and posted the applicable 2016-2026 employment projection data to its website October 24, 2017.

Occupational Outlook Handbook. The Handbook includes employment projections developed by BLS' Employment Projections program; BLS develops its projections from statistical and econometric models, combined with subjective analysis, and designs these projections to provide a focused analysis of long-term trends based on a set of assumptions.⁵ The models and analyses BLS uses to develop the projections assume historical relationships and behavior will continue to hold over the projection period; however, there is inherent uncertainty about whether historical trends will continue into the future. BLS employment projections rely on assumptions about demographics, fiscal policy (including tax policies and government spending), and macroeconomic conditions over the 10-year projection period. For example, the BLS projections assume that the economy will be at full employment in the last year of the period (e.g., 2026). BLS notes, however, that fluctuations in the business cycle are not foreseeable over a decade.⁶ Therefore, BLS employment projections should be considered as likely outcomes, but subject to the accuracy of the underlying assumptions. We determined that the BLS survey and projection data were sufficiently reliable for purposes of our objective.

To determine what data and information were available on workforce needs from industry, we reviewed reports and interviewed officials from industry associations, including the American Water Works Association, the Water Environment Federation, the National Rural Water Association, the Rural Community Assistance Partnership, the National Association of Clean Water Agencies, and the National Association of Water Companies. We identified a number of relevant industry studies, including three surveys published by the American Water Works Association between 2015 and 2017: the *2016 State of the Water Industry Report*, *Benchmarking Performance Indicators Water and Wastewater: 2015*

⁵In this report, we provide analyses of BLS "occupational separations" data. BLS uses two different models to produce the data. One model applies to "labor force exits" and the other to "occupational transfers." BLS notes that both models use a regression analysis of historical data to identify the characteristics of a worker, such as age and educational attainment, that influence likelihood of separating from the worker's current occupation. These patterns from historical data are then applied to the current distribution of worker characteristics for each occupation to project future separations. Bureau of Labor Statistics, *Employment Projections: Occupational separations and openings*, October 24, 2017, on the Internet at https://www.bls.gov/emp/ep_separations.htm.

⁶T. Lacey, Mitra Toossi, Kevin Dubina, and Andrea Gensler, "Projections overview and highlights, 2016–26," *Monthly Labor Review*, U.S. Bureau of Labor Statistics, October 2017, <https://doi.org/10.21916/mlr.2017.29>.

*Survey Data and Analyses Report, and Benchmarking Performance Indicators Water and Wastewater: 2013 Survey Data and Analyses Report.*⁷ To assess the reliability of the industry studies, we reviewed their scope and methodology. We determined that although the industry estimates were not generalizable, the studies were sufficiently reliable for illustrating industry perspectives on workforce planning.

To review the effects of potential unmet workforce needs on water utilities' abilities to comply with the Safe Drinking Water Act and the Clean Water Act, we selected a sample of 11 water utilities—6 large and 5 small—based on geography, size, and indications of hiring challenges in the past.⁸ We included both large and small utilities in our selection based on our initial interviews with industry representatives that suggested that large utilities and small utilities experienced different challenges.

To select the large utilities, we compiled a list of cities that were mentioned in interviews and other communications with industry groups, and in EPA documents, as experiencing difficulty replacing retiring workers or having put in place programs to train and recruit new workers. We then divided the list of cities geographically among the four Census regions—West, Midwest, Northeast, and South—and tallied the number of times each city was mentioned. In the West and South regions, we selected the city with the greatest number of mentions. In the Midwest and Northeast regions, each of the cities had only one mention, so we selected the largest city within each region. For each of these four cities we then identified the drinking water and wastewater utilities for the city. One of the cities had separate drinking water and wastewater utilities, while the other three cities had one utility that provided both drinking water and wastewater services. We also included the water utility for a fifth city because early in our research we conducted a site visit to that city and conducted an interview with the local water utility.

⁷American Water Works Association, *2016 State of the Water Industry Report* (2017); *Benchmarking Performance Indicators for Water and Wastewater Utilities: 2015 Survey Data and Analyses Report* (2016); and *Benchmarking Performance Indicators for Water and Wastewater: 2013 Survey Data and Analyses Report* (2015).

⁸EPA defines large utilities as those that serve more than 100,000 people. EPA defines medium drinking water utilities as those that serve between 3,300 and 100,000 people and small drinking water utilities as those that serve fewer than 3,300 people. The selected utilities that we interviewed range between those that serve fewer than 3,300 people and those that serve greater than 500,000 people.

To select the small utilities, we reached out to the National Rural Water Association and the Rural Community Assistance Partnership for suggestions on utilities to interview. The National Rural Water Association provided us with a list of 10 small water and wastewater utilities from 6 states. We divided the list of cities among the four Census regions. In the West region, one utility was recommended. For the Midwest, Northeast, and South regions, we selected utilities from cities with populations less than 10,000. In the South region, we selected a second city in order to bring the total number of small utilities up to five. One of the small utilities that we contacted was not able to participate in an interview with us but instead referred us to a nearby utility. That utility served a population less than 30,000, which for the purposes of this report we included in the category of small water utilities. Table 2 shows the locations and sizes of the 11 utilities we interviewed.

Table 2: Location and Population Served for 11 Large and Small Water Utilities Interviewed

Location	Population Served
California	>500,000
Colorado	>500,000
District of Columbia	>500,000
Indiana	<3,300
New Mexico	<10,000
New York	<10,000
Pennsylvania	>500,000
Tennessee	<30,000
West Virginia	<3,300
Wisconsin	>500,000
Wisconsin	>500,000

Source: GAO analysis. | GAO-18-102

We asked officials of the selected utilities whether workforce challenges had affected their abilities to comply with the Safe Drinking Water Act and the Clean Water Act at their utilities or whether they anticipated such effects in the future. The information from those interviews is not generalizable to the national population of water utilities; it was intended to provide illustrative examples of any difficulties water utilities were experiencing in complying with the Safe Drinking Water Act and the Clean Water Act that they attributed to workforce challenges. We also obtained EPA data on compliance with the Safe Drinking Water Act and the Clean Water Act for the selected utilities. We have previously reviewed the

quality of EPA compliance data for the Safe Drinking Water Act.⁹ Specifically, we have interviewed EPA officials and reviewed EPA data reliability assessments, a 2017 OIG report on the reliability of data in EPA's Safe Drinking Water Information System (SDWIS), data verification reports, and our past reports on the reliability of the data in SDWIS.¹⁰ According to these recent EPA assessments, the EPA OIG report, and our January 2006 and June 2011 reports,¹¹ some of the data in SDWIS are not complete. We also interviewed an EPA official and reviewed documentation on compliance data for the Clean Water Act. We determined that although the data are incomplete, they were useful to provide a rough indication of whether selected water utilities had any Safe Drinking Water Act or Clean Water Act compliance violations over the past 10 years (between 2007 and 2016).

To describe the approaches that selected water utilities have used to manage their workforce needs and the challenges they have faced in managing those needs over the past 5 years (from 2012 through 2016), we spoke with utility officials, during the interviews described above, to learn about their hiring and retirement numbers, challenges in managing workforce needs, and approaches for hiring staff. The information from those interviews is not generalizable to the national population of water utilities; it was intended to provide illustrative examples of any difficulties water utilities were experiencing in complying with the Safe Drinking Water Act and the Clean Water Act that they attributed to workforce challenges.

To describe how key federal programs can assist water utilities with their workforce needs, we conducted background research and initial interviews with federal officials. We identified five federal agencies that conduct activities or provide funding related to the water utility workforce: EPA, USDA, Education, DOL, and VA. We interviewed officials with these

⁹See GAO, *Drinking Water: Additional Data and Statistical Analysis May Enhance EPA's Oversight of the Lead and Copper Rule*, [GAO-17-424](#) (Washington, D.C.: Sept. 1, 2017).

¹⁰Environmental Protection Agency, Office of Inspector General, *EPA Is Taking Steps to Improve State Drinking Water Program Reviews and Public Water Systems Compliance Data*, 17-P-0326 (Washington, D.C.: July 18, 2017).

¹¹See GAO, *Drinking Water: EPA Should Strengthen Ongoing Efforts to Ensure That Consumers Are Protected from Lead Contamination*, [GAO-06-148](#) (Washington, D.C.: Jan. 26, 2006); and *Drinking Water: Unreliable State Data Limit EPA's Ability to Target Enforcement Priorities and Communicate Water Systems' Performance*, [GAO-11-381](#) (Washington, D.C.: June 17, 2011).

agencies about current or past federal programs and policies related to water utilities' workforce needs. We did not attempt to identify all programs that can provide assistance to water utilities for workforce planning or recruitment, but we determined based on interviews at the five federal agencies that we had identified the programs for which these activities were a primary purpose or likely use. Additionally, we interviewed representatives from the selected utilities we contacted to determine whether and how they had used various federal programs or assistance to augment other planning and recruitment strategies and what problems, if any, they had in using the programs. The information from those interviews is not generalizable to the national population of water utilities but provides illustrative examples of how, if at all, water utilities are using federal programs to help with workforce planning and recruitment.

We conducted this performance audit from September 2016 to January 2018, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: List of Federally Registered Apprenticeships at Drinking Water and Wastewater Utilities

Table 3 provides a list of apprenticeships in the water industry that are registered with the Department of Labor’s (DOL) Office of Apprenticeship. As of September 7, 2017, DOL reported that 24 utilities across the country were training new employees through registered apprenticeships that combined structured learning with on-the-job training with an assigned mentor.

Table 3: List of Federally Registered Apprenticeships at Drinking Water and Wastewater Utilities

Sponsoring Organization	Program Registration Date	State
National Rural Water Association ^a	August 10, 2017	Multiple States
Huntsville Water Department	August 1, 2016	Alabama
Navajo Tribal Utility Authority - Water/Wastewater ^a	March 16, 1989	Arizona
Central Arizona Project ^a	July 23, 1999	Arizona
City of Peoria	July 26, 2011	Arizona
Colorado Springs Utilities Water Construction and Maintenance	January 24, 2006	Colorado
Colorado Springs Utilities Water Systems Maintenance	October 15, 2007	Colorado
Colorado Springs Utilities - Water Resources	March 8, 1999	Colorado
Des Moines Metropolitan Wastewater Reclamation Facility	November 1, 2012	Iowa
Des Moines Water Works	July 7, 2014	Iowa
Metropolitan Water Reclamation District of Greater Chicago	September 3, 2008	Illinois
Pentair, Inc. DBA Aurora Pump	March 8, 2010	Illinois
United Water Services, Indiana	February 10, 1998	Indiana
Greenfield Water Utility	October 27, 2011	Indiana
Greenfield Wastewater Utility	October 27, 2011	Indiana
Winthrop Utilities District	August 17, 2015	Maine
Everett J Prescott, Inc.	June 18, 2012	Maine
Walkerville Well Drilling	December 3, 2010	Michigan
Abat Plumbing & Heating LLC	October 10, 2007	New Jersey
Atlantic County Utility Authority	September 20, 2006	New Jersey
Truckee Meadow Water - Supervisory Control and Data Acquisition	October 1, 2005	Nevada
Truckee Meadow Water Authority	August 23, 2001	Nevada
Division of Water Treatment, City of Toledo ^a	November 4, 1993	Ohio
Edmond Public Works Department, Field Services ^a	August 27, 2008	Oklahoma
Oklahoma Environmental Training Center	December 17, 2014	Oklahoma
City of Columbia - Water Services Department	December 15, 2011	South Carolina
City of Columbia - Metro Wastewater Treatment Plant ^a	July 24, 2012	South Carolina
City of Columbia - Wastewater Maintenance Division ^a	December 31, 2013	South Carolina
City of Florence	January 26, 2017	South Carolina

**Appendix II: List of Federally Registered
Apprenticeships at Drinking Water and
Wastewater Utilities**

Sponsoring Organization	Program Registration Date	State
West Virginia American Water Joint Apprenticeship Training Committee	September 25, 2012	West Virginia
Kingwood Water Works	February 17, 2015	West Virginia

Source: GAO summary of Department of Labor information. | GAO-18-102

^aSeven of the registered apprenticeship programs had no apprentices enrolled as of September 7, 2017.

Appendix III: Comments from the Environmental Protection Agency



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF WATER

DEC 27 2017

Mr. Alfredo Gomez
Acting Director
Natural Resources and Environment
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Gomez:

Thank you for the opportunity to review and comment on the General Accountability Office's draft report, *Water and Wastewater Workforce: Recruiting Approaches Helped Industry Hire Operators, but Additional EPA Guidance Could Help Identify Future Needs* (GAO-18-102). The purpose of this letter is to provide the Environmental Protection Agency's response to your recommendations. The EPA generally agrees with the GAO's findings, and provides comments regarding the conclusions and recommendations.

GAO's draft findings include the following:

Data suggests that replacement rates and workforce needs for water and wastewater operators are similar to workforce needs nationwide across all occupations, but little information is available on the current or future effects of unmet workforce needs on compliance with the Safe Drinking Water Act and Clean Water Act. EPA's sanitary survey and inspection guidance include information on workforce, but do not focus on collecting information for the utilities and states on future workforce needs. The utilities interviewed by GAO face challenges in meeting workforce needs. Some large utilities and associations report initiatives to better understand workforce issues and to address existing and future workforce needs. Small utilities do not report workforce planning initiatives, have difficulty hiring certified operators, and rely on hiring and training entry-level employees. The EPA and the Departments of Agriculture, Labor, Education and Veterans' Affairs have programs and activities that are designed to support utilities in addressing their workforce needs.

The report does not highlight some factors that differentiate water and wastewater sector workforce needs from the workforce needs of all occupations. For example, the location of the drinking water system or wastewater treatment plant can significantly impact the owner's ability to recruit and retain certified operators. In addition, while automation was discussed as one factor that may contribute to decreased workforce needs, this factor is unlikely to impact the workforce needs of small systems that are unable to afford or would otherwise not benefit from increased automation.

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**Appendix III: Comments from the
Environmental Protection Agency**

GAO Recommendation

GAO recommends that EPA add strategic workforce planning questions such as the number of positions and skills needed in the future, as well as potential gaps in water operator positions, to its inspection guidance documents.

EPA Response

Existing guidance documents for both sanitary surveys of drinking water systems and inspections of publicly owned treatment works recommend that the relevant Agency ask facilities questions regarding staffing. These activities – sanitary surveys and compliance monitoring inspections – have differing goals based upon the statute being implemented, the SDWA and CWA, respectively. The sanitary survey is a compliance assistance activity. One of the eight elements of the sanitary survey is Water System Management and Operation; as such, the survey may be an appropriate vehicle for surveyors to address workforce issues that may affect utility operations and compliance in the future. The Clean Water Act has no corollary. Under the CWA National Pollutant Discharge Elimination System program, compliance monitoring inspections are conducted at publicly owned treatment works to determine the facility's compliance with the obligations of the effective NPDES permit. As a result, CWA NPDES inspectors may be limited in the information related to workforce planning they can assess and provide. Where the agency identifies studies or documents on adequate staffing of wastewater facilities, the EPA Office of Enforcement and Compliance Assistance will incorporate that information into its existing guidance documents for CWA NPDES inspectors.

The agency generally agrees with the recommendation with respect to sanitary surveys of public water systems. EPA's Office of Ground Water and Drinking Water is in the process of updating the sanitary survey guidance manual *How to Conduct a Sanitary Survey of Drinking Water Systems – A Learner's Guide*. The agency will add questions related to workforce needs to the "Utility Management" section and anticipates finalizing the updates by the summer of 2018. After reviewing the utility of including these questions in sanitary surveys, the agency will identify additional opportunities to implement this recommendation, as appropriate.

Thank you again for the opportunity to review the draft report. The agency recognizes the importance of workforce development in the water and wastewater sector to ensure the protection of public health and the environment. If you have questions or need additional information, please contact me, or your staff may contact Cathy Davis at (202) 564-2703 or Davis.CatherineM@epa.gov.


for Larry Starfield
Acting Assistant Administrator
Enforcement and Compliance Assurance

Sincerely,



Michael H. Shapiro
Acting Assistant Administrator for Water

cc: EPA GAO Liaison Team

Appendix IV: GAO Contacts and Staff Acknowledgments

GAO Contacts

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Staff Acknowledgments

In addition to the contacts named above, Susan Iott (Assistant Director), Betty Ward-Zukerman (Assistant Director), Darnita Akers, Mark Braza, Caitlin Cusati, Alex Galuten, Tom Gilbert, Gina Hoover, Rich Johnson, Cynthia Norris, Rhiannon Patterson, Sarah Sullivan, and Paul Wright made key contributions to this report.

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